AGRONOMY 485/585*
SOIL & ENVIRONMENTAL MICROBIOLOGY
☺
Outline and Assigned Reading
Fall 2009

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If you have a documented disability and anticipate needing accommodations in this course, please make arrangements to meet with me soon. Please request that Disability Resources staff send a SAAR form verifying your disability and specifying the accommodation you will need.

A COURSE INTRODUCTION

A1 Text: Principles and Applications of Soil Microbiology, Syliva et. al., 2005, 2nd ed.
Required readings for the course are in **bold** and enhanced readings (no test questions asked but likely will aid in better understanding of the topic) are in *italics*. Some enhanced readings are written at a lower level than your text, others at a more in-depth level.

A2 References (on reserve in library)
http://www.lib.iastate.edu/cfora/reserve/courselist.cfm?cat=class_cour&navid=22602&parent=2016
Alexander--Biodegradation and Bioremediation, 1999 **(A)**
Coleman and Crossley--Fundamentals of Soil Ecology, 2004 **(CC)**
Coyne--Soil Microbiology, 1999 **(C)**
Konhauser--Introduction to Geomicrobiology, 2007 **(K)**
Paul--Soil Microbiology, Ecology, and Biochemistry, 2007 **(P)**
Tate--Soil Microbiology, 2000 **(T)**

A3 Grading and exams

	Points
Lecture	
1-hr exam	
October 8	100
November 5	100
Final (week of December 14)	150
Laboratory	
Three quizzes @ 20 pts each	60
Final	40
Laboratory Notebook	50
TOTAL	**500**

*Students taking the course as Agron 585 have additional expectations (see website).

A4 This course will provide you with an understanding of soil organisms, their types, numbers, activities, and will discuss soil life in relation to human existence, land use, and the environment. **"To appreciate them, one must understand them."** Observations, methods of isolation, enumeration, and means of studying transformations will be emphasized in the laboratory.

A5 Overview of importance--Why study soil biology?

A6 Historical accounts and the "Golden Age" of soil microbiology, **Text: 3-25;** *C: 3-12; P: 3-24.*

B SOIL AS A BIOLOGICAL ENVIRONMENT, Text: 26-53. If this is your first course in soil science, you also may wish to read *CC: 1-21* (good overview) and/or *C: 139-179; T: 1-29*. Confused with terms or concepts, ask to borrow from me an introductory soil science textbook.

B1 Soil composition--minerals, organic fractions, charge, size relationships

B2 Important variables--moisture tensions, atmospheric compositions, temperature, humus, pH

B3 Brief soil biota size/number overview

C METABOLIC REQUIREMENTS AND GENETICS, Text: 54-98; *C: 14-26; K: 10-18; T: 37-75, 133-154.*

C1 Water

C2 The Five Essentials--energy source (electron donor), electron acceptor, carbon source, minerals, and growth factors

C3 Growth curves

C4 Genetics and gene exchange

D BACTERIA, ARCHAEA, AND ACTINOMYCETES, Text: 101-139; *C: 100-123; K: 93-104..*

D1 What are soil bacteria and archaea?

D2 General taxonomy, morphology, and metabolic diversity

D3 Geochemical groupings

D4 Actinomycetes in soil as a distinguishable group

D5 Importance of actinomycetes

E FUNGI, Text: 141-161; *C: 86-99.*

E1 Differences among bacteria, actinomycetes, and fungi

E2 Taxonomy, selective media, and methods of investigation

E3 Bacterial spore and fungal conidia comparison

E4 Soil structure and fungal involvement

E5 Fairy rings

F CYANOBACTERIA AND ALGAE, Text: 162-180; *C: 77-85; K 179-183.*

F1 Growth requirements and significance in soil

F2 Kinds of soil algae

F3 Lichens and soil formation

G VIRUSES, Text: 201-221; *C: 124-136.*

G1 What are soil viruses?

G2 Determining presence in soil

G3 Activity and scope

H PROTOZOA, Text: 181-200; *C*: 67-76; *CC: 79-89; P: 163-169.*
H1 Most-probable-number (MPN) technique
H2 How to identify soil protozoa
H3 Motility and classification
H4 Cysts formation and separation from vegetative cells
H5 Environmental influences and significance

I NONPROTOZOA FAUNA, CC: 89-128, 169-181; *C:* 43-66; *P: 169-186.*
I1 Neglected group
I2 Nematodes
I3 Earthworms
I4 Others

J ECOLOGY AND METHODS FOR STUDY, Text: 222-241; *T: 37-94; P: 53-83, 85-118.*
J1 Real world interactions
J2 Direct methods
J3 Cultural methods and Biolog data
J4 Molecular methods
J5 Product transformations

K DECOMPOSITION OF ORGANICS, Text: 285-297*;* *K: 11-17, 206-208; T: 284-313.*
K1 Carbon cycle
K2 Types of organics
K3 Assimilation
K4 Mineralization and immobilization
K5 The art of composting, **Text: 587-606**

L COMMON ORGANICS IN PLANTS AND WASTES, Text: 298-318; Handouts; *C: 291-305; P: 312-325.*
L1 Cellulose
L2 Starch
L3 Hemicellulose
L4 Lignin
L5 Other polysaccharides, chitin, pectin, protein, and lipids

M ORGANIC MATTER AND SOIL QUALITY, Text: 318-332.
M1 Organic matter components
M2 Priming effect
M3 Management for high soil organic matter levels

N BIOREMEDIATION AND RECALCITRANT ORGANICS, Text: 510-535; *A: 393-406; K: 133-138; T: 464-494.*
N1 Human-produced organics (xenobiotics)
N2 Conditions for biological growth vs. cometabolism
N3 Microbial degradation pathways
N4 Tough bonds to break

O **BIOREMEDIATION TECHNOLOGIES IN SOIL, Text: 536-561;** *A: 325-349.*
O1 Criteria for bioremediation
O2 Land farming
O3 Phytoremediation
O4 Bioventing

P **THE RHIZOSPHERE AND ORGANISMAL DISTRIBUTION WITHIN THE SOIL, Text: 242-262;** *T: 218-235.*
P1 Exudates
P2 R/S ratios
P3 Beneficial and harmful effects
P4 Pathogenic relationships

Q **MYCORRHIZAE, Text: 263-282;** *P: 259-267*; *T: 235-244.*
Q1 Ectomycorrhiza
Q2 Endomycorrhiza
Q3 Environmental importance

R **THE NITROGEN CYCLE, Text: 333-278;** *P: 341-364*; *T: 314-346.*
R1 Historical--Schloesing and Muntz, Warington, and Winogradsky
R2 Nitrifying bacteria
R3 Environmental influences
R4 Nitrification inhibitors
R5 Denitrification
R6 Environmental factors and significance

S **NITROGEN FIXATION, Text: 373-432;** *P: 364-387*; *T: 347-403.*
S1 Nonsymbiotic
S2 Symbiotic
S3 The symbioses
S4 Biochemistry of the fixation process

T **NONCONVENTIONAL SOIL ADDITIVES, A: 299-323.**
T1 Inoculants
T2 Wonder products
T3 Evaluation

U **MICROBIAL PROCESSES AND THE ENVIRONMENT**, (no required reading), *Text: 433-488; C: 183-194, 208-227; K: 79-92.*
U1 Oxidation and reduction of sulfur (Why is the Black Sea black?)
U2 Oxidation and reduction of iron
U3 Heavy metal impacts in the environment and affects on organisms

Please let me know at anytime throughout the course how I can be of help.